

# Physico-Chemical Properties of *Indigofera Zollingeriana* Seed Oil

Alagbe J.O<sup>1\*</sup>, Adedeji M.O<sup>2</sup>, Habiba Z<sup>2</sup>, Nwosu Gloria<sup>2</sup>, Dabara Comfort Wyedia<sup>2</sup>

<sup>1</sup>Department of Animal Nutrition and Biochemistry, Sumitra Research Institute Gujarat, India.

<sup>2</sup>Department of Animal Science, University of Abuja, Nigeria.

\*Corresponding Author: Alagbe J.O, Department of Animal Nutrition and Biochemistry, Sumitra Research Institute Gujarat, India.

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## Abstract

The objective of the present study is to examine the physico-chemical properties of *Indigofera zollingeriana* seed oil. Physico-chemical parameters of oils are important in the determination of edibility and other industrial applications. All the laboratory analysis were carried out using standard procedures according to AOAC (2000). The acid value, peroxide value, iodine value, saponification value, refractive index and free fatty acids of cold pressed *Indigofera zollingeriana* seed oil was found to be 17.11 mg NaOH/g, 23.04 meq/kg, 180.4 gI<sub>2</sub>/100g, 118.7 mg/KOH/g and 14.10 %. The refractive index (20°C) and specific gravity (25°C) was 2.01 and 1.02 respectively. The extracted oil was Indigo in colour at liquid state. It was concluded the oil has a high acid value, peroxide value and free fatty acid which favours the use of the oil for industrial use such as soap production and cosmetics.

**Keywords:** *indigofera zollingeriana*; physico-chemical; fatty acid; seed; oil

## Introduction

*Indigofera zollingeriana* is a leguminous plant belonging to the family Papilionaceae. It had been cultivated and highly valued for centuries as main source of indigo dye, leading to its common names “true indigo” and “common indigo (Ali *et al.*, 2015). It is one of the widely used forage plant species used in Asia due to high quality forage production and adaptability to drought stress under tropic conditions (Herdiawan and Sutedi, 2012).

The plant has protein rich leaves with low tannin, lignin and cellulose contents, utilisable fibre (NDF and ADF) and high dry matter digestibility (Abdullah, 2010). Alagbe and Omokore (2019) reported that top leaf meal of *I. zollingeriana* contains 29.98% crude protein, 3.30% crude fat, 8.49% crude fiber, 0.52% calcium and 0.34% phosphorus. *Indigofera* plays important roles in increasing animal production and feed efficiency. This plant has a wide range of adaptation to various environmental conditions, tolerates to drought, light floods, and moderate salinity (Abdullah, 2010).

Seeds from *I. zollingeriana* have also been reported to be rich in minerals, vitamins, amino acid and phytochemicals which can inhibit the growth of pathogenic microorganism, improve palatability and voluntary intake in animals (Alagbe *et al.*, 2021; Alagbe, 2018). Physico-chemical analysis of seed oil is important in the determination of edibility and other industrial applications (Zubair *et al.*, 2018).

## Materials and methods

### Experimental site

The research was carried out in the Department of Animal Nutrition and Biochemistry, Sumitra Research Institute Gujarat, India.

### Collection, identification and processing of *Indigofera zollingeriana*

Mature and healthy seeds from *Indigofera zollingeriana* were harvested from different trees within the research institute. It was identified and authenticated by a certified taxonomist Professor Zing Liu and assigned a voucher specimen number STR/09R5. The seeds were sorted to remove the bad ones and mechanically separated from their pods with knife to obtain the seeds. It was later shade dried for 14 days to maintain the bioactive chemicals in the seeds and stored in a clean labeled container for further analysis.

### Extraction of *Indigofera zollingeriana* oil

Extraction of *Indigofera zollingeriana* oil (IZO) was done using a cold press machine (Model: ZZYX168, Yaun, China). The dried *Indigofera zollingeriana* seed (2000 g) was poured at into the feeder of the machine which works at a low temperature and IZO was collected via the squeeze cage, the process of extraction took 10 minutes.

### Physico-chemical analysis

Refractive index, acid value, peroxide value, saponification value, pH, iodine value, specific gravity and free fatty acid were determined using

Association of Analytical Chemist (2000) and analytical techniques of British Pharmacopoeia (1980).

## Result and Discussion

Physicochemical composition of *Indigofera zollingeriana* oil is presented in Table 1. The extracted oil was Indigo in colour at liquid state. Acid value, saponification, iodine, peroxide values ranged between 17.11 (mg NaOH/g of oil), 118.7 (mg/KOH/g of oil), 180.4 (gI<sub>2</sub>/100g of oil) and 23.04 (meq/kg) respectively. Refractive index is the ratio of the velocity of light in vacuum to the velocity of light in the medium is an indication of the level of saturation of the oil (Isman *et al.*, 2007). The iodine value obtained in this analysis indicates that it is below the normal recommended range for edible oil by WHO (2007). Iodine value is a measure of degree of unsaturation and it is an identity characteristic of seed oils, making it an excellent raw materials for soaps and cosmetic industries (Joulang and Konig, 1998). Oils with iodine value less than 100 gI<sub>2</sub>/100g of oil are non-drying oils; correspondingly, Franz *et al.* (2011) reported that the lower the iodine value the lesser the number of unsaturated bonds; thus the lower the susceptibility of such oil to

oxidative rancidity. High acid value in the oil showed that the oil may not be suitable for use in cooking (edibility), however, be useful for production of paints, liquid soaps and shampoos (Franz *et al.*, 2011). Saponification value is a measure of oxidation during storage and also indicates deterioration of the oils (Hedges and Lister, 2006). Free fatty acid in *Indigofera zollingeriana* oil is higher than the acceptable limits for edible oils. Its maximum limit is 4 mg/KOH/g oil (CODEX, 1992) for recommended international standards for edible oil. Peroxide value is a measure of peroxides contained in the oil and used in determining the degree of spoilage. The standard peroxide value for edible oils which have not undergone rancidity must be well below 10 meq/kg (Olayemi *et al.*, 2018).

## Conclusion

It was concluded that *Indigofera zollingeriana* seed is not edible oil because of its high acid value, peroxide value and free fatty acids. Their physico-chemical property reveals that it is suitable for industrial applications.

Parameter	Composition	*WHO (edible oil)
Colour	Indigo	NS
Odour	Agreeable	NS
State	Liquid	-
Acid value (mg NaOH/g of oil)	17.11	3.80 – 4.00
Saponification value (mg/KOH/g of oil)	118.7	170.0 – 181.0
Iodine value (gI <sub>2</sub> /100g of oil)	180.4	100.0 – 150.0
Peroxide value (meq/Kg)	23.04	10.0
Refractive index at (20°C)	2.01	1.47 – 1.51
Specific gravity at (25°C)	1.02	0.80 – 0.84
% Free fatty acid	14.10	5.78 -7.28

**Table 1:** Physicochemical properties of *Indigofera zollingeriana* oil \*WHO (1991)

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